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MMWR Weekly

September 2, 2005 / 54(34);842-847

Mental Health in the United States: Prevalence of Diagnosis and Medication Treatment for Attention-Deficit/Hyperactivity Disorder --- United States, 2003

Attention-deficit/hyperactivity disorder (ADHD), previously known as attention deficit disorder, is a neurobehavioral disorder characterized by pervasive inattention and hyperactivity-impulsivity that often results in substantial functional impairment (Box). Prevalence estimates of ADHD in school-aged children have ranged from 2% to 18% in community samples (*1*). Although stimulant medications are an effective first-line treatment for ADHD (*2*), concern persists regarding the possible side effects and long-term health outcomes associated with stimulant consumption (*1*). Estimating the number of children who have had ADHD diagnosed and are currently taking medication for the disorder is an important step toward understanding the overall burden of ADHD in the United States. Previously, population-based estimates of medication treatment for ADHD were not available or were limited by their lack of generalizability (*3*--*5*). To estimate rates of parent-reported ADHD diagnosis and medication treatment for ADHD, CDC analyzed data from the 2003 National Survey of Children's Health (NSCH). This report describes the results of that analysis, which indicated that, in 2003, approximately 4.4 million children aged 4--17 years were reported to have a history of ADHD diagnosis; of these, 2.5 million (56%) were reported to be taking medication for the disorder. Because both substantial health risks and benefits might be associated with medication treatment for ADHD, further study of this population of children with ADHD is needed.

NSCH is a survey about the physical and emotional health of civilian, noninstitutionalized, U.S. children aged ≤17 years (*6*). CDC conducted the 2003 NSCH during January 2003--July 2004 by using the State and Local Area Integrated Telephone Survey (SLAITS). SLAITS allows for sampling from the National Immunization Survey sampling frame. One child was randomly selected from households with at least one child aged ≤17 years. Parents or guardians responded to survey items on behalf of 102,353 sample children (completion rate: 68.8%). NSCH data were weighted to estimate national and state-specific rates of ADHD diagnosis and medication treatment among children aged 4--17 years.

As a proxy for ADHD diagnosis, respondents were asked, "Has a doctor or health professional ever told you that [child] has attention-deficit disorder or attention-deficit/hyperactivity disorder, that is, ADD or ADHD?" If an ADHD diagnosis was indicated, respondents were asked, "Is [child] currently taking medication for ADD or ADHD?" Estimates of reported ADHD diagnosis, current medication treatment among those with ADHD, and current medication treatment for ADHD among all children aged 4--17 years were calculated. Rates of medication treatment for ADHD among all children aged 4--17 years were calculated by using the number of children currently receiving medication as the numerator and all families who responded to the ADHD diagnosis question (affirmatively or negatively) as the denominator. Statistical software was used to adjust for the complex sampling design of NSCH. Statistical significance was concluded for those comparisons yielding an alpha level <0.05. Seventy-four sample children were excluded from sociodemographic comparisons because of missing data on their sex.

Prevalence and national population estimates of parent-reported ADHD diagnosis were calculated and compared by selected sociodemographic characteristics (Table). In 2003, approximately 7.8% (4,418,000; 95% confidence interval [CI] = 4,234,000--4,602,000) of U.S. children aged 4--17 years had ever had ADHD diagnosed. ADHD diagnosis was reported approximately 2.5 times more frequently among males than females (Figure 1). Prevalence of reported ADHD increased with age and was significantly lower among children aged 4--8 years compared with children aged ≥9 years (Table). The greatest prevalence was noted among males aged 16 years (14.9%) and females

aged 11 years (6.1%). The prevalence of reported ADHD diagnosis was significantly higher among non-Hispanic, primarily English-speaking, and insured children. Moreover, prevalence rates were significantly higher for children in families in which the most highly educated adult was a high school graduate (or had completed 12 years of education), compared with children in families in which the most highly educated adult had a higher or lower level of education. ADHD diagnosis among males was reported significantly more often in families with incomes below the poverty threshold (<100%) than in families with incomes at or above the poverty threshold. Rates of reported diagnosis among females were not significantly different across the three levels of poverty. Prevalence varied substantially by state, from a low of 5.0% in Colorado to a high of 11.1% in Alabama (Figure 2).

In 2003, an estimated 4.3% (2,473,000; 95% CI = 2,338,000--2,607,000) of children aged 4--17 years were reported to have ever had an ADHD diagnosis and were taking medication for the disorder. Rates of medication treatment for ADHD varied by age and sex and ranged from 0.3% to 9.3% (Figure 1). Regardless of sex, the overall medication-by-age patterns were curvilinear, with prevalence of medication treatment for ADHD highest among children aged 9--12 years, compared with younger or older children (Table). Rates of medication treatment for ADHD followed the same pattern noted for ADHD diagnosis, such that males of all ages were more likely to have a reported history of ADHD diagnosis and to currently take medication for the disorder (Table). More males aged 6 years were taking medication for ADHD (4.3%) than females at any age (Figure 1). The highest rates of medication treatment for ADHD by sex and age were reported among males aged 12 years (9.3%) and among females aged 11 years (3.7%). Medication treatment rates were significantly higher among non-Hispanic, primarily English-speaking, and insured children. Geographic variability in prevalence of medication treatment ranged from a low of 2.1% in California to a high of 6.5% in Arkansas (Figure 2).

Nationally, 56.3% of children with reported ADHD diagnoses were being treated with medication at the time of the survey. The frequency of medication treatment among males and females with reported ADHD diagnoses was not significantly different (56.8% versus 55.0%, respectively). Rates of medication treatment among those with a reported diagnosis varied by state, ranging from 40.6% in California to 68.5% in Nebraska (median: [57.6%]).

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Editorial Note:

This report provides the most recent national and state-specific estimates of the prevalence of children aged 4--17 years ever diagnosed with ADHD. The findings indicate considerable variability in ADHD diagnosis by state of residence and certain sociodemographic characteristics. Certain state variation in ADHD diagnosis might be attributed to underlying state differences in diagnostic practice, sociodemographic characteristics, or both.

This report is also the first to document national and state-specific prevalence of medication treatment for ADHD using national survey data. Although ADHD is considered a chronic condition, to what extent the "ever" diagnosed rate reflects current levels of clinical symptomatology is unclear. However, because children with ADHD often are not treated with medication, current medication treatment prevalence can serve as a minimum estimate of overall ADHD prevalence.

Several factors affect determination of the most appropriate ADHD therapy for children; however, clinical treatment guidelines exist that recommend efficacious pharmacologic and behavioral interventions (*7*--*8*). NSCH does not assess use of ADHD treatments other than medication. Thus, the number of children with reported ADHD diagnoses who received other types of treatments is not known. Children in racial/ethnic minority populations and uninsured children were less likely than others to be taking medication for ADHD. Additional research is warranted to investigate differential patterns in diagnosis and treatment of ADHD across demographic and geographic strata.

The findings in this report are subject to at least four limitations. First, because the data are based on parental reports of ADHD diagnosis and medication treatment, the accuracy of these reports are subject to recall bias, telephone survey selection biases, and other types of response errors. Second, the survey sampling design excluded institutionalized persons, who might have higher rates of ADHD and medication treatment. Third, the survey was only administered in English or Spanish and therefore excluded families speaking neither language. Finally, these data do not include undiagnosed ADHD or children without an ADHD diagnosis who are taking medication for similar symptoms.

This analysis was limited to two relevant NSCH questions pertaining to ADHD and cannot fully characterize current ADHD treatment patterns. No known national survey currently assesses ADHD-related impairment or the nature and extent of treatment for ADHD. Such data are necessary to characterize community care and might inform future public health action.

ADHD poses substantial costs both to families and society. The disorder has been associated with strained familial and peer relationships, suboptimal educational achievement, and increased risk for unintentional injuries (*1*,*7*,*8*). Health-care costs associated with ADHD are conservatively estimated at $3.3 billion annually (*9*). Moreover, persistent and negative side effects of stimulants have been documented, including sleep disturbances, reduced appetite, and suppressed growth, which might have important health implications for the millions of children who are currently taking medication for ADHD. Continued monitoring and community-based research activities that focus on sociodemographic and geographic variation in ADHD diagnosis and treatment are needed (*10*).

Acknowledgments

This report is based, in part, on contributions from Maternal Child Health Bur, Health Resources and Svcs Admin, US Dept of Health and Human Svcs. C Kennedy, MPH, R Perou, PhD, Div of Human Development and Disability, National Center on Birth Defects and Developmental Disabilities, CDC.

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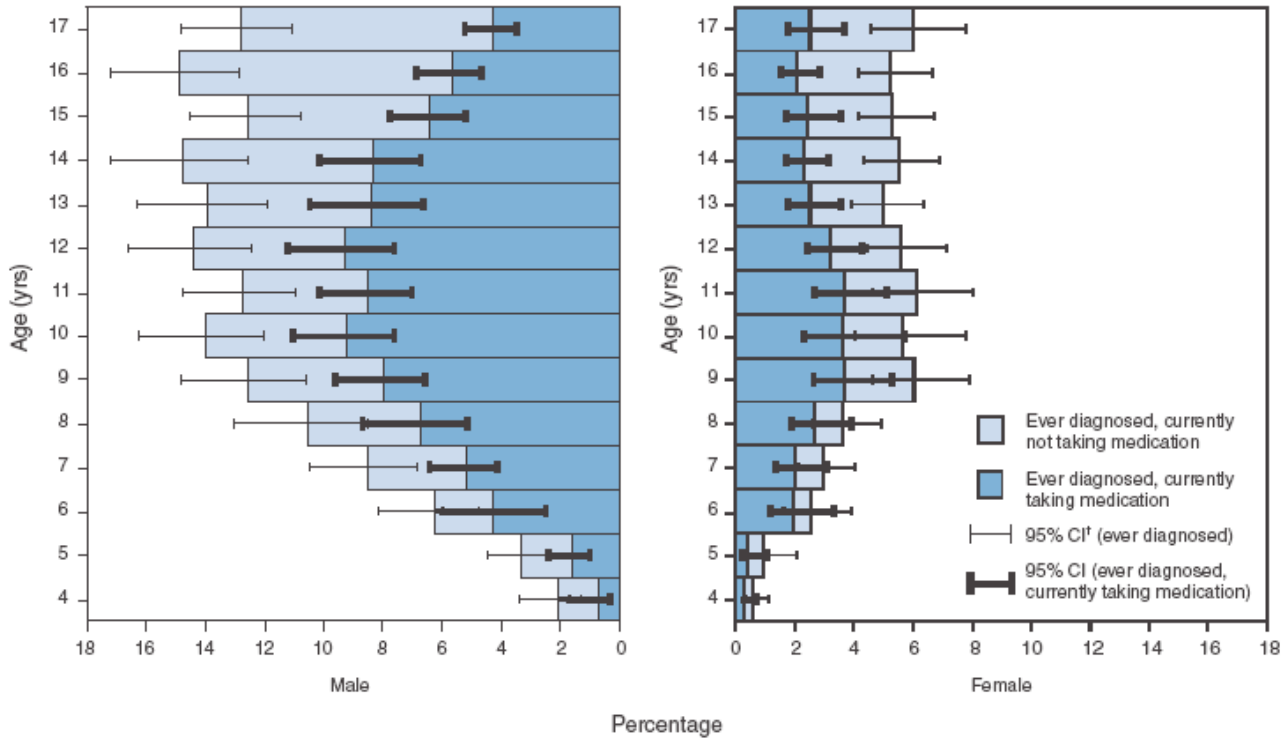
Figure 1

FIGURE 1. Percentage of children aged 4–17 years ever diagnosed with ADHD,* by age, sex, and medication treatment status — United States, 2003



* Attention-deficit/hyperactivity disorder.
† Confidence interval.

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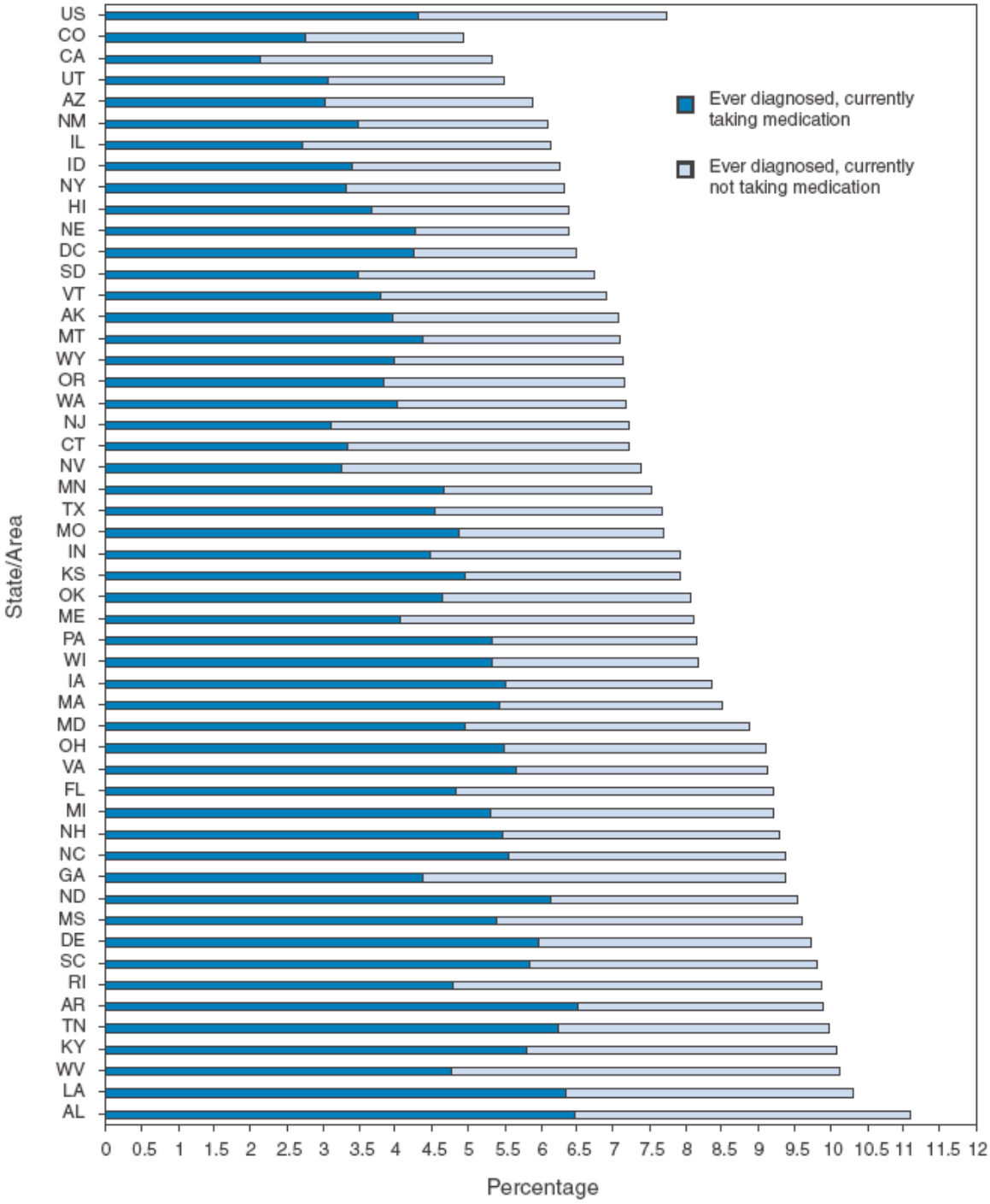
Figure 2

FIGURE 2. Percentage of children aged 4–17 years ever diagnosed with ADHD,* by medication treatment status and state/area — United States, 2003



* Attention-deficit/hyperactivity disorder.

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Table

TABLE. Weighted prevalence estimates of ADHD* ever diagnosed and current medication treatment for ADHD among children aged 4–17 years,† by sex and sociodemographic characteristics — United States, 2003

	Reported ADHD diagnosis						Currently taking medication for ADHD					
	Male		Female		Total		Male		Female		Total	
Characteristic	%	95% CI§	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
National prevalence¶	11.0	(10.4–11.5)	4.4	(4.1–4.8)	**7.8**	**(7.4–8.1)**	6.2	(5.8–6.6)	2.4	(2.2–2.7)	**4.3**	**(4.1–4.6)**
Age group (yrs)												
4–8	6.0	(5.3–6.7)	2.1	(1.7–2.5)	**4.1**	**(3.7–4.5)**	3.6	(3.1–4.20	1.5	(1.2–1.8)	**2.6**	**(2.3–2.9)**
9–12	13.5	(12.5–14.5)	5.9	(5.1–6.7)	**9.7**	**(9.1–10.4)**	8.8	(8.0–9.6)	3.6	(3.0–4.3)	**6.2**	**(5.7–6.7)**
13–17	13.8	(12.9–14.8)	5.4	(4.9–6.0)	**9.7**	**(9.2–10.3)**	6.7	(6.1–7.4)	2.4	(2.0–2.8)	**4.6**	**(4.2–5.0)**
Highest education in family												
Less than high school	9.5	(7.5–11.8)	3.3	(2.3–4.8)	**6.5**	**(5.3–7.9)**	4.6	(3.3–6.4)	2.0	(1.2–3.4)	**3.4**	**(2.6–4.4)**
High school graduate	12.9	(11.8–14.1)	4.2	(3.6–5.0)	**8.6**	**(7.9–9.3)**	6.8	(6.1–7.7)	2.3	(1.9–2.9)	**4.6**	**(4.1–5.1)**
More than high school	10.4	(9.8–11.0)	4.6	(4.2–5.1)	**7.6**	**(7.2–8.0)**	6.1	(5.7–6.6)	2.5	(2.2–2.8)	**4.4**	**(4.1–4.6)**
Race												
White	12.0	(11.4–12.6)	5.0	(4.6–5.4)	**8.6**	**(8.2–9.0)**	7.1	(6.6–7.6)	2.8	(2.5–3.2)	**5.0**	**(4.7–5.3)**
Black	12.0	(10.4–13.8)	3.6	(2.7–4.6)	**7.7**	**(6.8–8.7)**	6.0	(4.9–7.4)	1.5	(1.1–2.1)	**3.7**	**(3.1–4.5)**
Multiracial	13.5	(10.1–17.9)	5.8	(4.1–8.2)	**9.7**	**(7.7–12.2)**	6.5	(4.8–8.7)	3.0	(1.7–5.3)	**4.8**	**(3.6–6.2)**
Other	6.6	(4.6–9.2)	2.3	(1.0–5.0)	**4.5**	**(3.3–6.2)**	3.0	(1.9–4.7)	1.3	(0.4–4.6)	**2.2**	**(1.4–3.6)**
Ethnicity												
Hispanic	4.8	(3.9–5.9)	2.5	(1.8–3.4)	**3.7**	**(3.1–4.4)**	2.1	(1.6–2.7)	1.0	(0.6–1.7)	**1.6**	**(1.3–2.0)**
Non-Hispanic	12.2	(11.6–12.8)	4.8	(4.4–5.2)	**8.6**	**(8.2–8.9)**	7.0	(6.6–7.5)	2.7	(2.4–3.0)	**4.9**	**(4.6–5.2)**
Primary language in home												
English	12.3	(11.7–12.8)	4.9	(4.5–5.3)	**8.6**	**(8.3–9.0)**	7.0	(6.6–7.4)	2.7	(2.4–3.0)	**4.9**	**(4.6–5.2)**
Other	1.6	(1.1–2.2)	0.9	(0.5–1.8)	**1.3**	**(0.9–1.7)**	0.5	(0.3–0.8)	—**	—	**0.3**	**(0.2–0.5)**
Poverty††												
<100%	14.8	(13.1–16.8)	4.2	(3.4–5.1)	**9.6**	**(8.6–10.7)**	7.4	(6.2–8.8)	2.1	(1.6–2.8)	**4.8**	**(4.1–5.6)**
100%–199%	11.2	(10.0–12.5)	4.7	(4.0–5.6)	**8.0**	**(7.3–8.8)**	6.6	(5.6–7.6)	2.8	(2.2–3.5)	**4.7**	**(4.1–5.3)**
≥200%	10.2	(9.7–10.8)	4.5	(4.0–5.0)	**7.4**	**(7.1–7.8)**	6.1	(5.7–6.6)	2.5	(2.1–2.9)	**4.3**	**(4.1–4.6)**
Any health-care coverage												
Yes	11.4	(10.9–12.0)	4.5	(4.2–4.9)	**8.1**	**(7.7–8.4)**	6.7	(6.3–7.1)	2.5	(2.3–2.8)	**4.6**	**(4.4–4.9)**
No	6.5	(5.1–8.2)	3.2	(2.3–4.4)	**4.9**	**(4.0–5.9)**	1.7	(1.3–2.4)	1.3	(0.7–2.1)	**1.5**	**(1.1–2.0)**

* Attention-deficit/hyperactivity disorder.
† Estimates do not include children aged 2–3 years with reported ADHD diagnosis (n = 32) because small sample size yields substantial (>30%) relative standard errors.
§ Confidence interval.
¶ Sociodemographic estimates included data from 46,104 males and 43,680 females aged 4–17 years for a total of 89,784.
** Relative standard error >30%.
†† Federal poverty level.

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Box

BOX. Diagnostic criteria for attention-deficit/hyperactivity disorder (ADHD)

A. Either (1) or (2):

(1) six or more of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Inattention

(a) often fails to give close attention to details or makes careless mistakes in school work, work, or other activities

(b) often has difficulty sustaining attention in tasks or play activities

(c) often does not seem to listen when spoken to directly

(d) often does not follow through on instructions and fails to finish school work, chores, or duties in the workplace (not because of oppositional behavior or failure to understand instructions)

(e) often has difficulty organizing tasks and activities

(f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as school work or homework)

(g) often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)

(h) is often easily distracted by extraneous stimuli

(i) is often forgetful in daily activities

(2) six or more of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity

(a) often fidgets with hands or feet or squirms in seat

(b) often leaves seat in classroom or in other situations in which remaining seated is expected

(c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, might be limited to subjective feelings of restlessness)

(d) often has difficulty playing or engaging in leisure activities quietly

(e) is often "on the go" or often acts as if "driven by a motor"

(f) often talks excessively

Impulsivity

(g) often blurts out answers before questions have been completed

(h) often has difficulty awaiting turn

(i) often interrupts or intrudes on others (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

C. Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).

D. Clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. Symptoms do not occur exclusively during the course of a pervasive developmental disorder, schizophrenia, or other psychotic disorder and are not better accounted for by another mental disorder (e.g., mood disorder, anxiety disorder, dissociative disorder, or personality disorder).

ADHD Subtypes

Attention-deficit/hyperactivity disorder, combined type: if both criteria A1 and A2 are met for the preceding 6 months.

Attention-deficit/hyperactivity disorder, predominantly inattentive type: if criterion A1 is met but criterion A2 is not met for the preceding 6 months.

Attention-deficit/hyperactivity disorder, predominantly hyperactive-impulsive type: if criterion A2 is met but criterion A1 is not met for the preceding 6 months.

SOURCE: American Psychiatric Association. Diagnostic and statistical manual—text revision (DSM-IV-TR™, 2000). Arlington, VA: American Psychiatric Association; 2000.

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Date last reviewed: 8/31/2005

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